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Outcomes of Enhanced Prenatal Services for Medicaid-Eligible Women in Public and Private Settings

SYNOPSIS

Objective. With changes in Medicaid, more low-income women are receiving prenatal care in private practice settings. The authors sought to determine whether private settings can provide the enhanced prenatal support services for low-income women that have been offered for decades in public settings.

Methods. The authors analyzed birth outcomes of Medicaid-eligible women receiving care from public and private providers certified to deliver enhanced prenatal care services, which included assessments of nutritional, psychosocial, and health educational risks and individualized counseling along with clinical care. Birth outcomes were compared by type of provider setting using multivariate logistic regression models to adjust for differences in risks and use of care.

Results. Among settings certified to deliver enhanced perinatal support services, private physicians' offices had the best risk-adjusted birth outcomes and public health department clinics the worst, while public hospital clinics had outcomes no different from private physicians' offices. Adjusted for prenatal care use, outcomes were still better for women seen in private physicians' offices than for women seen in public health department clinics, community clinics, or private hospital clinics.

Conclusions. The findings suggest that given a certification process, private providers can provide enhanced support services as effectively as providers in public practice settings.

With expansions of Medicaid eligibility and Medicaid managed care for pregnant women, more low-income women are obtaining prenatal care in private practice settings.[1–4] To ensure the best possible birth outcomes for low-income women, it is important to know whether private and public ambulatory care practice settings differ in their ability to provide the enhanced multidisciplinary prenatal care services recommended for this population.

In public settings (health department clinics, public hospital clinics, and community clinics), specially designed nutritional, psychosocial, and health educational support services have been developed with Title V funding allocated through the Maternal and Child Health Bureau of the Public Health Service.[5–7] Public settings generally employ specially trained personnel to pro-

vide these enhanced services, which include assessments of nutritional, psychosocial, and health educational risks and individualized counseling. In contrast, private settings generally focus on screening, diagnosis, and treatment of the complications of pregnancy. While they tend to be staffed by medical personnel with more extensive training to deal with clinical complications,[8] private settings generally do not offer multidisciplinary support services tailored to the needs of low-income women. It is not surprising, therefore, that pregnant women have a better chance of receiving advice about such issues as drug abuse in public settings than in private physicians' offices.[9,10]

Enhanced prenatal care services that include assessments of nutritional, psychosocial, and educational risks; counseling, and follow-up along with clinical care have been formally recommended by the Public Health Service.[11] Although birth outcomes for low-income women have not been uniformly better with all such enhanced services in all settings,[12] better birth outcomes have been found in public practice settings with enhanced prenatal care support services than in private sector settings that may offer some health education or nutrition services.[5,13] One study found that women who received care only from private physicians had significantly higher odds of preterm low birth weight infants than those who received care only from the health department even after adjustment for differences in risks and regardless of whether the woman was transferred to the public hospital from another hospital during labor for fetal or maternal complications.[6] Women obtaining prenatal care in public settings have reported receiving information on more topics recommended by the Public Health Service than did women in private physician offices.[10]

When private providers are certified to deliver enhanced prenatal care services to low-income women, do their services compare favorably with those offered in public settings?

Several states have Medicaid reimbursement mechanisms that encourage providers to develop enhanced services.[1] In California, the Comprehensive Perinatal Services Program (CPSP) of the Maternal and Child Health Branch, Department of Health Services, certifies obstetric providers to deliver enhanced services to pregnant women on Medicaid.[14] Providers are paid for their services by Medi-Cal (California's Medicaid program). These services include assessments of nutritional, psychosocial, and educational risks; counseling; and follow-up and are coordinated through an individualized care plan for each woman. Any woman eligible for Medi-Cal prenatal services (income less than 200% of poverty and allowable assets not in excess of about $3000) is eligible for these CPSP services if she receives care from a CPSP-certified provider. In the process of certification, the provider demonstrates the capability of providing comprehensive care and agrees to document risks assessed and interventions performed in patients' medical records.

In an earlier study we demonstrated the effectiveness of these enhanced services for Medicaid-eligible women in California.[11] After adjusting for sociodemographic and reproductive risks, we found that women who received at least eight prenatal care visits and enhanced services from a CPSP-certified provider were less likely to have had a low birth weight baby than women receiving at least eight visits with a usual Medicaid provider.

For the present study, we looked at the variation in effectiveness of enhanced prenatal care services delivered by CPSP-certified providers.[14,15] Using medical data, nutritional and psychosocial assessments, and care plans we compared the services provided in five types of practice settings. We tested whether maternal risks, prenatal care services used, and the credentials of staff members providing prenatal support services varied significantly across provider settings. We then used multivariate regression analyses to examine whether any differences remained across the five types of provider setting in low birth weight and preterm birth outcomes after adjusting for differences in maternal risks and use of prenatal care visits. These analyses offer insight into differences in patient characteristics, use of care, and birth outcomes for low-income women in different types of practice settings.

Methods

Data collection. The provider sampling procedure has been described in a previous publication.[11] In brief, certified CPSP sites in two metropolitan and two nonmetropolitan regions of California were divided into five types: public hospital clinics, health department clinics, community clinics (primary care clinics not owned by government agencies that are licensed by the state of California to serve predominately low-income Medicaid and uninsured families), private physicians' offices, and private hospital clinics. For each region, we randomly selected one or, where available, two sites of each type for study. Because in each of the four regions we could not identify two settings of each type that were certified and providing services, a total of 29 sites were selected. Although all selected sites agreed to participate, abstraction of charts became impossible at one of the selected sites, and it was dropped from the study, leaving 28 sites—three public

hospital clinics, six health department clinics, eight community clinics, six physicians' offices, and five private hospital clinics.

The metropolitan regions were the Los Angeles and San Francisco Bay areas with eight sites each, and the two nonmetropolitan regions were the Central Valley and Sacramento Valley/Sierra areas with six sites each. The Los Angeles area was bounded by Los Angeles county lines. The Bay Area included San Francisco, Alameda, Contra Costa, Santa Cruz, and Santa Clara Counties. The Central Valley area encompassed San Joaquin, Stanislaus, Tuolumne, Merced, Mariposa, Monterey, San Benito, Fresno, and Madera Counties. The Sacramento Valley area consisted of Solano, Sacramento, Amado, Calaveras, Alpine, El Dorado, Sutter, Yolo, Placer, Lake, Colusa, Yuba, and Nevada Counties.

The medical charts of all Medicaid clients who gave birth between June 30, 1989, and December 31, 1990, and who received at least one clinical visit and one CPSP nutritional, psychosocial, or health education assessment were abstracted sequentially until all charts or a total of 140 had been abstracted for each site. The final sample for this study was 3633 women with live births.

Analytic variables. The outcome variables were low birth weight (less than 2500 grams) and preterm birth (less than 36 completed weeks). Gestational age at birth was assigned by ultrasound examination results if an ultrasound was performed between 14 and 22 weeks' gestation.[15–17] We used the ultrasound estimation of gestational age at birth for those other cases in which the estimation did not differ by more than two weeks from the gestational age based on the date of the last menses. In all remaining cases, gestational age was estimated from the date of last menses.

Risk-adjusted birth outcomes varied by practice setting: women seen in physicians' offices had better outcomes than those seen in health department clinics.

We identified sociodemographic, medical, obstetrical, behavioral, and prenatal care use characteristics that could potentially affect the association that we were testing between practice setting and the birth outcomes.[18] We then adjusted measured associations for these potentially confounding variables using logistic regression models. Sociodemographic variables that were included in the adjustment included ethnicity, age, and marital status. Maternal age at delivery was divided into high risk (younger than 18 or older than 34) and low risk (ages 18 to 34) categories. Marital status was classified as either married or unmarried, with the latter including single, widowed, separated, and divorced. Ethnicity was obtained from medical charts.

We constructed a single dichotomous medical risk variable for each outcome using the clinical condition of pregnancy associated with the largest effect on each outcome.[18–23] Medical risk for low birth weight was defined as the presence of three or more of the following conditions: (*a*) *chronic conditions*: chronic renal disease; diabetes mellitus; chronic hypertension; a structural abnormality of the reproductive tract; or cardiac disease (functional class III or IV); (*b*) *conditions during the current pregnancy*: bacterial infection; vaginal bleeding after the first trimester; urinary tract infection or pyelonephritis; hypertension; preeclampsia or toxemia; oligohydramnios; chorioamnionitis or amnionitis; chlamydia; structural anomaly noted by ultrasound; a hemoglobin test value below 11.0 in the first or third trimester or below 10.5 in the second trimester; or a hematocrit test value below 33% in the first or third trimester or below 32% in the second trimester. We found that in our study sample low birth weight was significantly more likely in women with three or more of these risk conditions, and thus the adjustment variable required at least three of these conditions be present.

Medical risk for preterm birth was defined by the presence of two or more of the following conditions:[18,22,23] a pre-pregnancy history of chronic renal disease, structural abnormality of the reproductive tract, or diabetes mellitus; or during the current pregnancy a bacterial infection, vaginal bleeding after the first trimester, urinary tract infection or pyelonephritis, hypertension, pre-eclampsia or toxemia, oligohydramnios, chorioamnionitis or amnionitis, or chlamydia. We found that in our sample preterm birth was significantly more likely in women with two or more of these risk conditions, and thus the adjustment variable required at least two of these conditions be present.

We adjusted for obstetrical risks by constructing variables for parity, poor pregnancy history, low pre-pregnancy weight and gender of the infant. All women were divided into one of the following categories: primigravid, multigravid without a poor pregnancy history, and multigravid with a poor pregnancy history. A poor pregnancy history was defined as having experienced at least one of the following: low birth weight infant, preterm infant, fetal death, spontaneous abortion, ectopic pregnancy, hydatidiform mole, or a short pregnancy interval of less than 365 days between the date of the last birth and the end of 40 weeks of the present pregnancy. In addition, we adjusted measurements of the association between practice setting and low birth weight for both low pre-pregnancy body mass index (BMI, defined as a BMI less than 19.8 kg per square meter

of body surface area) and for the sex of the infant since female babies tend to have lower birth weights.[19]

We also adjusted for smoking behavior during pregnancy (ascertained by maternal self-report).

In testing the association of type of practice setting with adverse pregnancy outcomes, the adequacy of the use of prenatal care can be considered a characteristic of the women and therefore adjusted between sites or a characteristic of the site and therefore not adjusted. We therefore tested these associations with and without adjustments for adequacy of prenatal care use. As in the Adequacy of Prenatal Care Utilization (APNCU) index, the adequacy of use of prenatal care visits reflected how early and how frequently prenatal care visits occurred during a pregnancy.[25] In the APNCU index, onset of care is grouped into four categories (gestational months 1–2, 3–4, 5–6, or after month 6). Adequacy of use of care is represented by calculating the percent of the visits recommended for an uncomplicated pregnancy by the American College of Obstetricians and Gynecologists (ACOG) that each woman attends. Because of the small numbers of women at these sites with inadequate amounts of prenatal care visits (less than 50% of recommended visits for an uncomplicated pregnancy), we collapsed the two categories of low use of care (less than 50% and less than 80%) to form a single category for women receiving less than 80% of recommended visits. The category for high use of care in this study (more than 120% of recommended visits) has a limit of 120%, instead of 110% as in the APNCU index, because enhanced services tend to add an additional early visit to the ACOG recommended visits to allow completion of all the initial support service assessments regardless of when during gestation services begin.[26] All women in the sample received at least one prenatal care visit; therefore there were no assignments to the categories of zero visits or missing data.[24] When we adjusted the regression analyses for prenatal care use, we also adjusted for whether or not a woman had received any prior prenatal care visits at another site since the onset of care and total visits reported in the medical chart could be affected by this.

We also included as a use of care variable the location of the services (metropolitan versus non-metropolitan). Clearly this could instead have been classified as a maternal demographic characteristic. Location, however, was included as an adjustment variable because it was found in our sample to be a predictor of poor birth outcomes independent of the other sociodemographic characteristics of the women.

Analyses. Univariate analyses of potentially confounding risk variables and birth outcomes were performed first to determine the distribution of risk characteristics and adequacy of prenatal care use by provider setting type. To avoid large numbers of multiple comparisons, we performed statistical tests of differences in the variables across all setting types. We used Pearson chi-square analyses to compare distributions of risk variables across setting types.[26,27] *P* values less than 0.05 are considered statistically significant. All variables that differed by setting were tested for intercorrelations, and none had Pearson correlation coefficients greater than 0.2. We then could include them as independent variables in a multivariate model measuring the associations between setting type and each birth outcome.

Since we sampled pregnant women by clusters in setting sites, the observations being analyzed were not strictly independent. There were potential correlations in characteristics among women sharing a particular site. Thus, General Estimation Equations were used to make conservative estimates of the associations between provider setting types and birth outcomes that did not assume outcomes were independent of the provider site.[29] The statistical significance of the differences between odds ratios was assessed using 95% confidence intervals.[30] Odds ratios whose 95% confidence intervals do not overlap with 1.00 are considered significant. We assessed how well the equations fit the data using three different measures of the goodness of fit: the *c* statistic measuring the percent of paired subjects whose outcome was predicted by the model risk parameters (50% predicted by chance, 100% predicted by fully determined model); the reduction in log likelihood (and associated chi-square *P* value) by the covariates in the model; and examination of the *P* value associated with the Hosmer-Lemeshow c-hat statistic (a chi-square statistic derived from a comparison of the expected number of cases with the observed number of cases across 10 deciles of cases ranked by their risk estimates).[30]

In the final analysis, we tested whether measures of the quality of the nutritional, psychosocial, and health education support services as described in the medical charts could help to explain any differences in birth outcomes in different setting types. We determined whether practice settings differed in the distribution of characteristics of the support services they provided. For each type of practice setting. we characterized the women according to whether they received an assessment in all three areas as recommended by the California Department of Health Services and by the specialization of the educational credentials of their initial provider of these services. To avoid large numbers of multiple comparisons of these service characteristics, we used Pearson chi-square analyses to compare distributions of risk variables across setting types.[26,27] We also analyzed the mean time spent in assessment and counseling in each of the three support service areas by provider setting type using analysis of variance and Tukey's studentized t-tests.[27,28]

Results

Risk characteristics. The distribution of sociodemographic, medical, obstetrical, and behavioral risk characteristics for low birth weight and preterm birth outcomes differed significantly across the different types of practice settings (see Table 1). Thus it was important to adjust tests of the associ-

Table 1. Characteristics of a sample of women receiving services under the Comprehensive Perinatal Service Program, by type of practice setting, California, 1989–1990 (*N* = 3633)

Characteristic	3 public hospital clinics (n = 416) Percent	6 health department clinics (n = 798) Percent	8 community clinics (n = 1064) Percent	6 private physicians' offices (n = 699) Percent	5 private hospital clinics (n = 656) Percent	P value[a]
Age (years)						
Younger than 18	6.3	16.7	8.5	11.7	10.8	
18–24	49.8	43.7	47.4	49.1	52.4	
25–34	38.2	34.8	40.4	33.8	32.2	
35 and older	5.8	4.8	3.8	5.4	4.6	<0.001
Marital status						
Unmarried	67.8	50.9	46.4	72.5	69.5	<0.001
Married	32.2	49.1	53.6	27.5	30.5	
Ethnicity						
African American	8.9	3.3	9.8	19.3	14.2	
Latina	22.6	74.9	58.3	31.2	20.7	
Southeast Asian	1.2	1.0	3.0	0.3	10.1	
White	58.2	16.8	17.2	38.1	52.0	
Other	9.1	4.0	11.7	11.2	3.0	<0.001
Medical risks for low birth weight						
None	44.5	49.9	49.0	41.1	44.8	
1–2	45.4	44.9	45.9	47.5	46.6	
3 or more	10.1	5.3	5.2	11.4	8.5	<0.001
Medical risks for preterm birth						
None	65.4	73.9	71.9	67.4	72.7	
1	28.1	21.2	22.9	26.2	22.3	
2 or more	6.5	4.9	5.2	6.4	5.00	0.048
Obstetrical history						
Primigravida	32.7	37.1	37.8	25.6	26.8	
Multigravida with poor history	21.9	21.2	20.8	21.7	26.7	
Multigravida without poor history	45.4	41.7	41.4	52.6	46.5	<0.001
Low body mass index	17.3	8.1	12.2	11.3	14.2	<0.001
Smoked during pregnancy	36.5	9.6	11.0	23.2	27.3	<0.001

NOTE: Percentages do not add to 100 in every case because of rounding errors.
[a]Pearson chi-square test

ation between type of practice setting and birth outcomes for the differences in risk factors across the practice settings.

Use of prenatal care visits. Women differed in their use of prenatal care by provider setting type (Table 2). Onset of care differed across setting types ($P<0.001$), as did the use of subsequent prenatal care visits ($P<0.001$) and the proportions of women who started prenatal care at a different site ($P<0.001$). Practice settings also varied in terms of metropolitan versus nonmetropolitan location ($P<0.001$). Since the use of prenatal care is partly influenced by individual characteristics (such as beliefs about the usefulness of preventive care) and partly by provider characteristics (such as scheduling practices), it is important to perform tests of the association between provider setting types and birth outcomes both with and without adjustments for differences in the use of prenatal care visits within the practice settings.

Birth outcomes. Unadjusted birth outcomes did not vary by practice setting (Table 2). After adjustment for risk characteristics, however, the birth outcomes in public health departments were significantly worse than in private physicians' offices (see Table 3). This was true for both low birth weight (odds ratio [OR] 1.66, confidence interval [CI] 1.12,2.45) and preterm birth (OR 1.55; CI 1.17,2.06). When the odds were adjusted further for differences in use of prenatal care (prior prenatal care, onset of care, and adequacy of visits), birth outcomes were still worse in public health department clinics than in physician's offices, but they were also worse in private hospital and community clinics than in physicians' offices (Table 3). The odds of low

Table 2. Prenatal care characteristics and birth outcomes in a sample of women receiving services under the Comprehensive Perinatal Service Program, by type of practice setting, California, 1989–1990 (N = 3633)

Variable	3 public hospital clinics (n = 416) Percent	6 health department clinics (n = 798) Percent	8 community clinics (n = 1064) Percent	6 private physicians' offices (n = 699) Percent	5 private hospital clinics (n = 656) Percent	P value[a]
Prenatal care						
Onset of prenatal visits (months of pregnancy)						
1–2	14.7	14.2	30.5	28.2	25.0	
3–4	39.7	41.0	43.4	38.1	40.2	
5–6	28.4	33.6	20.8	23.2	26.4	
Later than 6	17.3	11.3	5.3	10.6	8.4	<0.001
Prenatal care visits						
Attended 120% or more	15.1	18.8	12.5	32.2	20.1	
Attended 80%–119%	60.1	69.3	50.6	57.2	62.2	
Attended 50%–79%	21.9	10.9	30.8	9.6	16.0	
Attended less than 50%	2.9	1.0	6.1	1.0	1.7	<0.001
Prior prenatal care elsewhere	16.6	12.8	4.6	21.7	14.5	<0.001
Location						
Metropolitan	66.6	65.0	50.5	46.8	20.9	
Non-metropolitan	33.4	35.0	49.5	53.2	79.1	<0.001
Outcome						
Low birth weight rate	5.0	6.0	5.3	4.7	5.5	0.851
Preterm birth rate	7.2	10.4	7.9	7.7	7.3	0.154

NOTE: Percentages do not add to 100 in every case because of rounding errors.
[a]Pearson chi-square test

birth weight infants for women seen in public hospital clinics were not significantly higher than for those seen in physicians' offices (OR 1.23; CI 0.81,1.87) and were significantly lower than for those seen in health department clinics (OR 2.13; CI 1.47,3.09) since neither odds ratio was within the 95% confidence interval of the other ratio. The odds of low birth weight in health department clinics were highest but within the confidence intervals of those in both community clinics (OR 1.89; CI 1.09,3.28) and private hospital clinics (OR 1.71; CI 1.15,2.53).

A similar relationship was found for preterm birth, with public health departments again exhibiting higher odds ratios compared with physicians' offices with or without adjustment for prenatal care use. Outcomes in public hospital clinics, on the other hand, did not differ significantly from those in private physicians' offices regardless of the use of prenatal care. Whether or not community clinics and private hospital clinics had significantly higher odds of preterm birth outcomes depended on whether the odds were adjusted for the higher proportions of women with low use of care (less than 80% of the prenatal care visits recommended for women with uncomplicated pregnancies).

Enhanced services. Since physicians' offices had better risk-adjusted outcomes than health department clinics, it is important to examine which characteristics of the nutritional, psychosocial, or health education services were better in physicians' offices than in public health departments. The support service measures we investigated included whether or not a woman received an assessment in all three support service areas, the credentials of the assessment provider, and the mean time spent in assessment and counseling in each support service area (Table 4). The support services did vary significantly by type of practice setting, but not in ways that fully explain the differences in outcome measures.

A difference in the number of women assessed for risks in all three areas does not explain the difference in outcomes. Nearly all women seen in public health department clinics (97.2%) had an assessment in all three service areas, as recommended by the CPSP program. In physicians' offices the proportion was lower (90.4%), not higher.

A difference in specialist credentials also does not explain the worse outcomes in the health department clinics. Of the specialist credentials examined—registered dieticians, master's in social work and master's in health education—only the use of registered dietitians appears to be consistent with the outcomes. A smaller proportion of women in public health department clinics was assessed for

Table 3. Adjusted odds ratios and confidence intervals (CI) in birth outcome models with and without adjustment for use of care in a sample of women receiving services under the Comprehensive Perinatal Service Program, California, 1989–1990 (*N* = 3633)

	Without adjustment for use of care				*With adjustment for use of care*			
	Low birth weight[a] (n = 3633)		*Preterm birth[b] (n = 3633)*		*Low birth weight[c] (n = 3633)*		*Preterm birth[d] (n = 3633)*	
Covariates	*Odds ratio*	*95% CI*	*Odds ratio*	*95% CI*	*Odds ratio*	*95% CI*	*Odds ratio*	*95% CI*
Provider setting								
Public hospital	0.91	0.54,1.55	0.88	0.61,1.28	1.23	0.81,1.87	1.37	1.00,1.87
Health department clinic	1.66	1.12,2.45	1.55	1.17,2.06	2.13	1.47,3.09	2.50	1.77,3.53
Community clinic	1.39	0.90,2.15	1.13	0.74,1.73	1.89	1.09,3.28	2.18	1.20,3.96
Private physician	1.00	...	1.00	...	1.00	...	1.00	...
Private hospital	1.40	0.89,2.19	1.03	0.70,1.50	1.71	1.15,2.53	1.50	1.12,2.00
Location								
Metropolitan	1.76	1.20,2.57	1.39	1.06,1.83	1.72	1.17,2.54	1.37	0.96,1.95
Non-metropolitan	1.00	...	1.00	...	1.00	...	1.00	...
Marital status								
Unmarried	1.00	0.69,1.44	1.11	0.81,1.54	1.04	0.72,1.51	1.10	0.81,1.50
Married	1.00	...	1.00	...	1.00	...	1.00	...
Ethnicity								
African American	1.98	1.35,2.92	2.44	1.56,3.82	2.21	1.50,3.28	2.56	1.52,4.32
Latina	1.05	0.68,1.61	1.46	1.01,2.10	1.04	0.66,1.64	1.41	0.92,2.16
Southeast Asian	1.72	0.99,3.00	1.94	1.02,3.68	1.40	0.76,2.57	1.50	0.66,3.41
White	1.00	...	1.00	...	1.00	...	1.00	...
Other	0.92	0.59,1.46	1.13	0.65,1.97	0.94	0.54,1.62	1.24	0.71,2.17
Maternal age (years)								
Younger than 18 or older than 34	1.17	0.85,1.61	1.21	0.85,1.71	1.19	0.87,1.64	1.24	0.86,1.79
18–34	1.00	...	1.00	...	1.00	...	1.00	...
Obstetrical history								
Primigravida	2.50	1.71,3.64	1.36	1.01,1.82	2.43	1.63,3.62	1.30	0.93,1.82
Multigravid with poor history	2.50	1.64,3.83	1.97	1.42,2.73	2.50	1.66,3.75	2.04	1.47,2.84
Multigravid without poor history	1.00	...	1.00	...	1.00	...	1.00	...
Medical risks								
High	2.58	1.55,4.31	2.08	1.22,3.54	2.20	1.37,3.54	1.63	1.03,2.57
Low	1.00	...	1.00	...	1.00	...	1.00	...
Nutrition risk								
Low body mass index	1.73	1.17,2.57	1.72	1.21,2.44	1.67	1.12,2.51	1.66	1.16,2.38
Not low body mass index	1.00	...	1.00	...	1.00	...	1.00	...
Risk behavior								
Smoked during pregnancy	2.41	1.79,3.24	1.84	1.44,2.37	2.54	1.87,3.45	1.95	1.49,2.55
Did not smoke	1.00	...	1.00	...	1.00	...	1.00	...
Sex of infant								
Female	1.26	0.93,1.70	...	...	1.18	0.88,1.59	...	...
Male	1.00	...	1.00	...	1.00	...	...	...
Prior prenatal care elsewhere								
Yes	...	...	...	...	0.76	0.46,1.27	0.90	0.55,1.47
No	...	...	...	...	1.00	...	1.00	...
Prenatal care visits								
Attended less than 80% of expected	...	...	...	...	0.70	0.39,1.28	0.66	0.35,1.24
Attended 80%–119%	...	...	...	...	1.00	...	1.00	...
Attended 120% or more	...	...	...	...	2.55	1.91,3.39	5.97	4.44,8.03
Onset of prenatal care								
Later than month 6	...	...	...	...	0.48	0.28,0.81	0.80	0.47,1.34
Month 5 or 6	...	...	...	...	0.91	0.68,1.23	1.12	0.76,1.65
Month 3 or 4	...	...	...	...	0.97	0.68,1.39	1.07	0.78,1.46
Month 1 or 2	...	...	...	...	1.00	...	1.00	...

[a]Goodness of fit characteristics: $c = 0.705$, -2 log likelihood chi square 112.7, df=17, $P = 0.0001$, Hosmer-Lemeshow c-hat 2.2, df=8, $P = 0.9727$.

[b]Goodness of fit characteristics: $c = 0.659$, -2 log likelihood chi square 97.8, df = 16, $P = 0.001$, Hosmer-Lemeshow c-hat 15.0, df=8, $P = 0.0582$.

[c]Goodness of fit characteristics: $c = 0.743$, -2 log likelihood chi square 155.7, df=23, $P = 0.0001$, Hosmer-Lemeshow c-hat 11.1, df=8, $P = 0.1939$.

[d]Goodness of fit characteristics: $c = 0.762$, -2 log likelihood chi square 282.1, df=22, $P = 0.0001$, Hosmer-Lemeshow c-hat 6.7, df=8, $P = 0.5722$.

Table 4. Support services provided to a sample of women receiving services under the Comprehensive Perinatal Service Program, by type of practice setting, California, 1989–1990 (*N* = 3633)

Variable	*3 public hospital clinics (n = 416)* Percent	*6 health department clinics (n = 798)* Percent	*8 community clinics (n = 1064)* Percent	*6 private physicians' offices (n = 699)* Percent	*5 private hospitals clinics (n = 656)* Percent	*P value*[a]
Assessment in all three areas[b]	89.9	97.2	95.2	90.4	85.8	<0.001
Initial provider[c] credentials						
Nutrition						
Registered dietitian	97.9	25.5	33.2	61.5	62.1	
Nursing degree	1.3	49.1	15.3	36.6	38.0	
Health worker	0.0	22.2	20.2	0.2	0.0	
Other generalist	0.8	3.2	31.3	1.7	0.0	<0.001
Psychosocial[d]						
Master's in social work	82.5	15.8	8.9	17.8	21.0	
Nursing degree	0.4	40.4	11.0	43.0	39.2	
Health worker	0.0	9.3	32.1	0.0	0.0	
Other generalist	17.0	34.6	48.0	39.3	39.8	<0.001
Health education						
Master's in health education or public health	0.5	0.0	12.5	0.0	36.7	
Nursing degree	64.6	85.7	12.0	53.0	43.4	
Health worker	0.0	10.4	45.9	0.0	5.0	
Other generalist	35.0	3.8	29.5	47.0	14.8	<0.001
Mean time spent (minutes)						
Nutrition	57	54	69	52	62	0.0001
Psychosocial[d]	63	57	44	76	70	0.0001
Health education	79	203	173	181	199	0.0001

NOTE: Percentages do not add to 100 in every case because of rounding errors.

[a]Pearson chi-square *P* values; for continuous variables (mean values are shown), *P* values are for analysis of variance F values.

[b]The three risk assessment areas were nutrition, psychosocial, and health education.

[c]The initial provider was defined as the provider performing the initial risk assessment in each of the assessment areas.

[d]Psychosocial data were not accessible at one physician site (*n* = 139), which was therefore excluded from psychosocial and total assessment analyses, leaving 3494 observations.

nutritional risks by registered dietitians (25.5%) than in physicians' offices (61.5%, $P<0.01$). In public hospital clinics, which had outcomes that were not significantly different from those in physicians' offices, nearly all women (97.9%) were seen first by registered dieticians. Although birth outcomes were significantly worse in private hospital clinics than in physician's offices after adjustments for prenatal care use, there was no difference in the proportion of women who were initially assessed by registered dietitians (62.1% versus 61.5%), but the proportion was significantly lower for private hospital clinics than for public hospital settings (97.9%, $P<0.01$).

Differences in the mean amount of time spent on support service assessment and counseling were inconsistent with outcomes. The only significant difference between physicians' offices and public health department clinics in time spent on services was a difference in the mean amount of time spent on psychosocial services, which was higher in physicians' offices (76 minutes compared to 57 minutes, $P<0.05$). However, the mean amount of time spent on psychosocial services did not differ between private hospitals and private physicians' offices or between public hospitals and health department clinics. Furthermore, the total average time spent in delivering support services differed by only five minutes between public health departments (314 minutes) and physicians' offices (309 minutes), which was not a statistically significant difference.

Discussion

A number of proposals for improving pregnancy outcomes stress that both public and private providers should

provide enhanced prenatal care to low-income pregnant women.[8,25,31,32] Concerns have been expressed that many private sector providers' lack of training and experience with services to address socioeconomic risks to the health of low-income women could hinder women from receiving the full range of enhanced services they need.[8]

Low-income women in our study received multidisciplinary prenatal health services from public or private providers certified to provide enhanced support services. After adjustments for differences in case mix, including sociodemographic, behavioral, medical, and obstetrical risks, women seen in private physicians' offices were found to have better birth outcomes than women receiving care in public health department clinics. When further adjusted for differences in use of prenatal care, outcomes in physicians' offices were still better than those in public health department clinics and were also better than those in community clinics and private hospital clinics. Outcomes for women receiving care in public hospital clinics, however, did not differ from those for women seen in physicians' offices with or without adjustments for case mix or use of visits.

These results indicate that private provider settings can provide multidisciplinary support services for low-income women with comparable or better results than public settings. They do not indicate, however, what the results would have been for low-income women seen in physicians' offices without support services or in the absence of a certification process that (*a*) approved risk assessment protocols and staffing for nutritional, psychosocial, and health education services and (*b*) required that women in need be referred to public programs as needed for food, income and shelter assistance, substance use services, and dental care.

A key issue in interpreting these results is whether the analyses of birth outcomes should be adjusted for prenatal care use. Once a woman contacts a provider to start care, the provider, in scheduling visits, influences the timing and number of visits. But to a great extent individual circumstances determine the extent to which women keep scheduled visits.[34,35] The timing and number of prenatal care visits, as well as the effectiveness of the content of the visits, can potentially influence birth outcomes.[19,25] Without an adjustment for prenatal care use, practice setting effects could be confounded directly by how early and how often women come for services and indirectly by the self-selection factor of women with healthy behaviors coming earliest and most often.[36] If, however, one adjusts for both timing and number of the visits, then outcomes can be attributable to the effectiveness of the content of the services received.

Women seen in public health department clinics had worse outcomes than those seen in physicians' offices regardless of adjustment for use of care. The size of the effect was even greater when use of care variables were included in the model. Thus, for similar levels of use of care, outcomes were worse than expected in health departments when compared to physicians' offices. Although these findings are disturbing, it should be remembered that they are based on just six health department clinics in California. Four were in metropolitan areas and two were not. Since the variation in health department clinics can be substantial, drawing inferences about public health clinics in general based on these six sites should be done with caution. In addition, a serious limitation of this observational study is that there may be a selection bias of women who use health department clinics that affects the outcome measures and is not fully accounted for by the case mix adjustment methods used in this study.

The finding of worse outcomes in community clinics and private hospital clinics than in physician's offices only after adjustment for use of care is intriguing. This could have occurred because (*a*) these two types of sites had outcomes similar to private physicians' offices but had fewer women in a use of care group (or groups) associated with poor outcomes or (*b*) these two types of sites had poorer birth outcomes than private physicians' offices for the same use of care group. Both conditions appear to have been present (bivariate analyses not shown). Community clinics and private hospitals did have fewer women who received an intensive schedule of visits (120% or more of those expected for an uncomplicated pregnancy), and these women had poor birth outcomes. In addition, outcomes in community clinics and private hospital clinics were poorer compared with private physicians' offices for similar amounts of care.

Thus, the better outcomes in women seen in physicians' offices than in community clinics and private hospital clinics could be due to care being more effective in physicians' offices. The differences are not likely to be due to lower risks of poor outcomes of the women seeking care from private physicians given the higher risk profiles of the women in the physician office group. These women had higher rates of smoking, of extreme low weight-for-height, and of medical risks of poor birth outcomes (Table 1). More of these women received some prior prenatal care elsewhere, and in analyses not shown, half these women (49%) with prior care elsewhere were found to have an intensive schedule of visits, compared with a quarter of the women (27%) seen in physicians' offices who did not start care elsewhere. Thus more women receiving care from these private physicians appeared to have been referred for care of complications of pregnancy.

Limitations of the study. Given the limitations of provider-based retrospective cohort studies, researchers should always look for alternative explanations of their findings. There are limitations to the abilities of risk adjustment variables to fully account for case mix differences,[37,38] especially with respect to low birth weight and preterm birth as outcome indicators.[12,39] We found that a significant risk of poor birth outcomes remained for women with high use of visits after adjustments for demographic, obstetrical, medical, and behavioral risk factors (Table 4). Women with high use of care had adjusted relative odds of low birth weight more than twice as large as those with an expected amount of vis-

its (OR 2.55; CI 1.91,3.39) and nearly six times as large of preterm birth (OR 5.97; CI 4.44,8.03). Thus, adjustment for intensive use of visits in these analyses appears to be adjusting in part for differences in severity of risk not captured in the medical risk variables.

The case-mix adjustment variable we used for medical risks assumes each component of risk contributes equally to the adverse outcome and that additional numbers of risks are associated with higher rates of each adverse outcome. It is possible that this method of case mix adjustment does not account for possible differences in medical risk assessment and reporting among different providers of care. Further research is needed to improve the risk adjustment models for case mix differences.

The finding that public health departments had worse outcomes irrespective of differences in prenatal care use could also be explained by factors other than the effectiveness of care received. For example, smoking was the only behavioral variable reported well in the medical records. Alcohol and drug use were substantially underreported in the medical records (5% of all cases); thus we could not adjust for differences in alcohol and drug use, which may have varied substantially between women seeking care in physicians' offices and other practice settings.

Additionally, all Medi-Cal eligible women are grouped together in these analyses because we could not distinguish women eligible because they were Aid to Families with Dependent Children (AFDC) recipients, with incomes less than 100% of Federal poverty levels, from women who were eligible because they were pregnant and uninsured (with incomes less than 200% of Federal poverty levels and allowable assets not in excess of about $3000). This latter group of women has been shown to be at lower risk of poor birth outcomes than the former.[40] It is possible that setting type acts as a proxy for differential distribution of women by income or other socioeconomic attributes within the Medicaid-eligible population. However, physicians in private practice saw the highest proportion of unmarried women (72.5%), which is more likely to be a characteristic of women eligible for Medicaid through AFDC than of those eligible because of pregnancy.

Finally, another factor that was not adjusted for in this study is that private physicians' offices tend not to be located in communities with chronic and severe poverty and high rates of violence, homelessness, and other environmental factors potentially contributing to worse outcomes. Health department clinics and community clinics tend to be located in communities underserved by private providers.[41] In addition, we found poorer risk-adjusted outcomes in urban areas than in non-urban areas, which was assumed to be in part an environmental measure of the extent of poverty of the urban low-income women. We did not find poorer outcomes in public hospital clinics, however, which were also established in communities underserved by private providers.

It is possible that physician practices that are among the first group of participants in a multidisciplinary service program such as CPSP may be different from private providers in general. Participation in the program entails training and certification and a commitment to providing multidisciplinary perinatal services to low-income women. We found in a survey that private CPSP physicians tended to have been in practice fewer years than other Medi-Cal participating physicians providing obstetric services (23% for less than five years).[15] They saw more Medi-Cal-eligible patients and more pregnant patients than the other physicians. Not surprisingly, the greatest difference between CPSP participating physicians and the other physicians participating in Medi-Cal but not CPSP was satisfaction with the $1011 global fee for obstetric care. More also reported they had good relations with Medi-Cal and fewer reported suspended or denied claims.

If effectiveness of the services received is a factor in the differential outcomes across the settings, then it is of interest to examine obstetric staffing characteristics. In a survey of CPSP Medi-Cal providers we found that most prenatal care was provided by obstetricians in both private physicians' offices and private hospital clinics.[15] In health departments, community clinics, and public hospital clinics, most ambulatory care was provided by certified nurse midwives, nurse practitioners, or physician assistants. At the majority of settings, however, a board-certified obstetrician-gynecologist was available to see patients on site. The physician practice settings did not differ systematically in other ways that might explain the differences in outcomes from those of other types of settings. Further research is needed to profile the characteristics of prenatal care service delivery in physicians' offices associated with improved birth outcomes.[42] Additional analyses will be needed to determine whether better outcomes in physicians' offices are associated with differences in the characteristics or quality of support services. Variations across types of practice settings in the quality and effectiveness of support services may have more influence than setting type on outcomes.

Implications. At a time when increasing numbers of states are turning to private managed care systems for their Medicaid populations,[1] this study provides some important lessons. Although earlier studies showed better birth outcomes in public settings, the support services provided at public and private sites were very different in those studies.[5–7] The findings of this study suggest that with support services added to routine obstetric services, private physicians can provide services to low-income women with comparable or better outcomes than in public settings.

What will be crucial is whether Medicaid encourages the development of quality support services in private practice settings providing managed care. For public health department and community clinics, our study points to the possible need to improve the effectiveness of care.[8,41,43] In the case of health department clinics, our findings suggest that the lack of relative effectiveness was not in the area of

support services but may have been in the use and content of clinical services. Expanding eligibility and coverage for low-income women will not be enough to improve pregnancy outcomes. Attention needs to be paid to the effectiveness of providers and the content of care.

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